Global Veterinaria 4 (6): 571-575, 2010
ISSN 1992-6197

Some Blood Biochemical Parameters and Yield of Lambs Fed Ration Contained Dried Grape Pomace

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Abstract: An experiment was conducted to evaluate the effects of inclusion of different levels of dried grape pomace (DGP) in ration of male lambs on some biochemical parameters such as cholesterol (Chol.), triglyceride (TG), total protein (TP), hematocrit, hemoglobin contents and the growth performance . Twenty-five 100-day-old Lori-Bakhtiari male lambs obtained with an initial live weight of 25 ± 0.21 kg were fed the experimental rations, which were formulated in accordance with the NRC-1994. Treatments were arranged in a completely randomized design of five treatments with 5 replicates each (0, 5, 10, 15 and 20% DGP) and lambs were observed during 84 days growth period. Dry Matter Intake (DMI) was daily measured and daily weight gain (DWG) was determined fortnightly. Feeding male lambs on diets containing 5 and 10 % DGP significantly improved their growth performance ($P<0.01$) as compared to the other treatments. Among biochemical parameters, TG level was significantly increased by diet supplementation of DGP as compared with control. Amounts of TP, hematocrit and hemoglobin of blood did not change by inclusion of DGP In conclusion, inclusion of 5% DGP in the ration could be useful in fattening male lambs with considerable low blood TG and Cholesterol contents.

Key words: Dried Grape Pomace · Performance · Blood · Male Lamb

INTERODUCTION

Feed is the single highest cost associated with raising small ruminants, typically accounting for 60% or more of total production costs. It goes without saying that nutrition exerts a very large influence on flock reproduction, milk production and lamb and kid growth. The importance of agricultural residues as potentially useful feed materials is well-known. Agricultural by-products have many uses in Asia because they forma significant part of the animals's feed [1]. Grape pomace (GP), a remnant of the puree agricultural by-products that can contribute to addressing shortage of animal feedstuffs. These by-products (tomato, apple and grape pomaces), consist of different amounts of skin, pulp, seeds and, if not removed, stalks with very high lignin content [2]. In many countries, the seasonal utilization of GP in animal feeding is common, because of its low cost. Abel and Icking [3] reported that dried or ensiled GP is low in energy content, but it can be used as a part of diets for ruminants fed close to maintenance level, especially for sheep. Based on *in vitro* studies, Famuyiwa and Ough [4] suggested that low dry matter digestibility of GP can be explained in terms of the structural composition of the cell wall fraction. Motta Ferreira *et al.* [5] concluded that GP could partially replace alfalfa as fiber source in diets for rabbits without adversely affecting growth. In Germany, the importance of GP as feedstuff has decreased over the last 40 years [6] in recent decade, these by-products are used in feeding ruminants either fresh or after drying, ensiling or dehydration, with substantial reduction in costs of diets [7, 8].

In Iran, GP production exceeds 50000 ton/year [7]. Tannins are known to negatively affect digestibility of crude protein, caused by the binding capacity to proteins and formation of tannin-protein complexes [9]. Drying or ensiling are two common methods of preserving these by-products, for easy usage of undegenerated leftovers and without other problems associated with fresh forms. The nutritive value of major pomaces varies depending on source plant, husbandry practice, fruit maturity and extraction process used to make juice, puree or fermenting

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[9]. Kayouli and Lee [10] reported that feeding dairy cows with 1 to 3 kg/day with grape pomace can be performed in replacement with expensive dry matters which have the same nutritional value. Recent investigations [11] showed that processed GP such as dried GP affect digestibility of the diet and can be effective for fattening lambs, which is accompanied by economic advantages. Remember that the cheapest feedstuff may not always be the most economical ingredient.

We investigated whether incorporation of dried grape pomace to ration for 90-d affects growth performance and alters the blood amounts of cholesterol, triglyceride, total protein, hematocrit and hemoglobin of sheep? The presented experiment was therefore, conducted to evaluate the effects of DGP on growth performance and some biochemical parameters of male lambs.

MAERIALS AND METHODS

Animal Feeding: Twenty five Lori Bakhtiari male lambs (the average body weight = 25±0.21kg, 100 day old) were divided into five groups in a completely randomized design and fed on the diets formulated in accordance with the NRC [12], twice per day at 08.00 and 14.00 h individually throughout the experiment, free access to the diets and fresh water.

Also, a free choice salt-vitamin-mineral premix was available at all times. Mid-Atlantic soils are typically deficient in selenium, thus the premix was fortified with selenium to prevent white muscle disease in lambs and reproductive problems in females in other study. Supplementing selenium via the feed or mineral is preferred to giving selenium injections. Fresh GP [13] were obtained from Iranian source and all GPs were dried naturally for a period of 2 days. The composition and calculated nutrient content of diets fed to lambs is shown in Table 1.

The refusals of diets offered to the male lambs were recorded daily. The animals were weighed at every fourteen days intervals in the morning to record average daily gain and feed yield. Whole diet that was offered at the beginning of each period was recorded and subtracted from the leftover collected at regular intervals.

Chemical Composition: Mean chemical composition of DGP (%) and it's metabolizable energy (Mcal/kg) are shown in Table 2. The chemical composition of dried grape pomace was determined by the method of AOAC [14]. The ADF and NDF were measured according to the methods described by Van Sost *et al.* [15]. The amount of tannin was obtained according to the method of Makker *et al.* [16] and was performed by calculation of phenolic ingredients contents, before and after tannin in terms of insoluble polivinilprolidin [17].

Table 1: Composition and calculated nutrient content of diets fed to lambs[1,2]

	Experimental diets				
Feedstuffs[3] %	T1	T2	T3	T4	T5
DGP	0.00	5.00	10.00	15.00	20.00
Barley	50.46	49.88	49.21	48.63	47.96
Alfafa	35.84	30.94	26.10	21.21	16.36
Wheat	3.83	3.83	3.83	3.83	3.83
Soybean meal	8.49	8.90	9.25	9.64	10.09
Calcium carbonate	0.92	0.99	1.15	1.23	1.30
Soil	0.46	0.46	0.46	0.46	0.46
Total	100.00	100.00	100.00	100.00	100.00
Calculated nutrient content					
ME (Mcal/kg)	2.50	2.60	2.60	2.60	2.60
Crude protein (%)	15.30	15.30	15.30	15.30	15.30
Calcium (%)	0.50	0.50	0.50	0.50	0.50
Available P (%)	0.30	0.30	0.30	0.30	0.30
NDF (%)	32.27	32.50	32.20	32.00	31.00
ADF (%)	18.60	18.10	17.70	17.30	16.80

[1] Diets fed to lambs with the average body weight = 25 ± 0.2 kg from 100 to 184 day age of growth period. [2] TT = treatment 1;

T1-T4= 0% (control), 5%, 10%, 15% and 20% DGP, respectively; [3] DGP: dried grape pomace, DM: dry matter, NDF: neutral detergent fiber, ADF: acid detergent fiber, TT: total tannins, TP: total phenols, CP: crude protein, ME: metabolizable energy.

Table 2: Mean chemical composition and metabolizable energy of dried grape pomace[1].

Item	Feed stuff (DGP)
DM (%)	89.00
NDF (%)	47.10
ADF (%)	31.20
TT (%)	5.40
TP (%)	0.34
CP (%)	12.80
ME (Mcal/kg)	2.05

[1] DGP: dried grape pomace, DM: dry matter, NDF: neutral detergent fiber, ADF: acid detergent fiber, TT: total tannins, TP: total phenols, CP: crude protein, ME: metabolizable energy.

Blood Sampling and Serum Biochemistry: Blood was collected from lambs (15 h post-feeding) 10 d before slaughter in heparinized vacuum tubes and immediately placed in ice before centrifuging at 1000 × g for 15 min at 4°C to recover serum. The serum was immediately frozen (-20°C). for determination of total protein, cholesterol and triglyceride levels. Hematological parameters including red blood cell, white blood cel counts, hematocrit and hemoglobin contents were performed,. Chemical analyses of sample were performed at the local hospital [18] by dry slide techniques of vitreous Products chemistry.

Table 3: Fattening performance parameters[1] of male lambs according to different amounts of dried grape pomace in diets

	Experimental diets						
Variable	T1	T2	T3	T4	T5	SE	P
BW, kg (100 days)	25.22	25.56	25.38	25.68	25.72	0.42	NS
FBW, kg (183 days)	42.06^{b}	43.08^{b}	45.28^{a}	39.80^{c}	37.50^{d}	0.73	**
DWG, g day^{-1}	200.40^{bc}	207.47^{ab}	236.77^{a}	171.13^{cd}	140.17^{d}	38.06	**
DMI, kg day^{-1}	1.24^{a}	1.19^{ab}	1.22^{a}	1.14^{b}	1.04^{c}	1.02	**
FCR, (g feed: g gain)	6.56^{ab}	6.09^{b}	5.55^{b}	7.99^{a}	8.08^{a}	1.60	* *

^{a,b,c,d} Means along the rows with no common superscript are significantly different (P<0.05). [1]Values are means of ten observations per treatment and their standard errors. BW= Body weight, FBW= Final body weight, DWG= Daily weight gain, DMI= Dry matter intake, FCR= Feed Conversion Ratio. T1-T4= 0% (control), 5%, 10%, 15% and 20% dried grape pomace, respectively; [3] P: NS= P>0.05; *= P<0.05; **= P<0.01.

Table 4: Blood biochemical parameters in the serum of experimental animals[1]

	(mg/dl)						
Blood biochemical values	T1	T2	T3	T4	T5	SE	[2]P
Cholesterol	67.00	61.20	63.00	66.20	59.80	5.37	NS
Triglycerde	17.60	19.80	28.00	25.60	29.40	7.43	**
Total protein	7.74	7.75	7.90	8.32	7.82	0.44	NS
Hematocrit	14.98	16.60	15.70	18.87	16.62	3.13	NS
Hemoglobin	8.28	9.62	8.44	8.00	9.56	0.90	NS

^{a,b,c,d} Means along the rows with no common superscript are significantly different (P<0.05). [1]Values are means of ten observations per treatment and their standard errors. T1-T4= 0% (control), 5%, 10%, 15% and 20% DGP, respectively; [2]P: NS= P>0.05; *= P<0.05; **= P<0.01.

Statistical Analysis: Data were analyzed as a complete randomized design with five treatments and 5 replicates, using SAS statistical package [19]. Means were compared with Duncan's multiple range test at (P<0.05).

RESULTS

Growth Performance: Dry matter intake (kg day^{-1}), average daily gain (g day^{-1}), feed conversion ratio and final body weight (kg) of male lambs fed rations containing 5 and 10 % DGP were significantly improved as compared to the other treatments (Table 3). The present results showed that adding DGP at 10 % of ration can be useful in fattening male lambs without negative effects on performances.

Biochemical Parameters: It is obvious from Table 4 that dried grape pomace didn't showed significantly meaningful difference on the number of corpuscle, cholesterol, total protein and hematocrite as compared to control group. Among biochemical parameters, TG level was significantly increased by ration supplementation of DGP as compared with control. The groups fed 5 to 20% DGP had the highest and lowest contents in the lambs blood (29.4 and 17.6 mg/dl, respectively). Amounts of TP, hematocrit and hemoglobin of serum did not showed differences t, although, the group fed from 20% DGP not significantly had the lowest serum C content, followed by dietary goups of 5% DGP (P>0.05).

DISCUSSION

In the present study, mean growth performance value for fattening performance increased when DGP percentage increased from 0 to 5 and 10% (200.4, 207.47, 236.77, respectively) but the addition of DGP to lambs ration more than 10% can not improves performance (171.13 and 140.17 g day^{-1} for 15 and 20%, respectively). DM intake deceased in these groups (1.14 and 1.04 kg day^{-1}, respectively) and feed conversion ratio (FCR) increased to 7.99 and 8.08 (P<0.05) respectively. Liobera and Canellas [20] found similar results when grape pomace was added to ration.

Such differences in the chemical composition of GP can be expected due to the morphology of the original grape, the extraction technique and probably drying method used. Diet containing 20% dried GP had lowest value of daily DMI (Table 3). The dry matter intake of treatments with 10 and 15% GP did not significantly differ when compared to the control group, but was significantly different from the treatments with 15 and 20% GP. The treatment containing 10 % dried grape pomace

was shown to have the most increased weight (45.28 kg) while the treatment containing 20% dried grape pomace had the least final body weight (37.5 kg). The dried grape pomace is an important source of protein and therefore, it was expected that fattening of lambs would improve with its increase in dietary level. Effects of some factors such as high fiber, lignin and tannin, which exist in fruit leftover, can decrease the rate of movement s of foodstuff in the digestive system [21, 22] and increase retention time of diet , thus decreasing food consumption. Magomedov *et al.* [23] observed improved average daily gain when sheep were fed on diets containing silage from grape residues. According to the findings of Mole and Waterman [24], working on 38 different animals, high levels of tannins (10-20%) in dried GP can result in decreased growth performance of sheep.

The feed conversion rate (FCR) was significantl increased ($P<0.05$) after adding 5 to 10 % of dried GP to diets when compared to the control group; the treatment with 10 % DGP had the best FCR. The higher FCR in this treatment could be related to changing maintenance requirements of animals that required higher energy for weight gain [25]. On the one hand, Huber [1] reported that using fruits leftovers in diet in high proportions has a negative effect on feed conversation ratio and fattening of animals. Therefore, the results of current study indicated that utilization of ration 3 (with 10% DGP) did showed the best response in male lambs compared to the other rations.

It was previously reported that diet supplementation with 5 to 10 % of olive meal can cause a decrease in serum cholesterol of laying hens. The main reason could be due to existed high percentages of fiber in olive meal that can decrease serum cholesterol, as reported by Magomedov *et al.* [23]. Dried grape pomace also, contains high fiber, especially tannin and lignin [10], however, fiber (bulk) is necessary to maintain a healthy rumen environment and prevent digestive upsets in small ruminants. Liobera and Canellas [19] reported that Dietary fibre content and antioxidant activity of manto negro red grape (Vitis vinifera): pomace and stem affects digestibility and utility of GP for fattening and produce a healthy product. Antioxidant activity of GP can influences circulation of cholesterol and triglyceride in arteries and tissues.

Hemoglobin and hematocrit values were not significantly influenced by treatment. More difference occurred within groups than between groups. DGP resulted in no significant influence on either the rate of gain or hematopoiesis. It was previously documented that grain byproducts, such as corn silage may be the most common scources of aflatoxins [26], which are secondary mold metabolites produced by some strains of *Aspergillus flavus* and *Aspergillus parasiticus* [27]. Grape pomace may also be a source of aflatoxins because the ensiling process does not destroy toxins already present in silage. Although, small ruminants are not susceptible to aflatoxicosis than beef and dairy cattle, but other mycotoxicoses may occur in these species, such as facial eczema in sheep [28]. The best work for suppress their activity is drying act of grape pomace open air. There are no consistent diagnostic changes in hematocrit, hemoglobin and differential cell counts in animals fed DGP. Also, serum protein levels are not typically changed.

It can be concluded that dried grape pomace can supplement to ruminant diets. It can be used as a substitute for good quality grasses and roughages, preferably in dried form in ration of lambs. Economic benefits can be realized by using DGP in the formulation of a low-cost ration which improves FCR and growth performance. Utilization of DGP at 5% level of ration could be useful in fattening male lambs with consider to lower blood TG and C contents. It is therefore, appropriate and recommended to add these fruit leftovers to the small ruminant rations. Dried GP may be a useful supplement for sheep feeding, but further work is required to understand its digestion and nutritional value and utilization in big ruminants.

ACKNOWLEDGMENTS

The presented study financially assisted in part by Islamic Azad University Research Science of Khourasgan Branch, Iran. However, the support of Young Researchers Club is gratefully acknowledged. The authors are grateful to Dr. A. D. Froozandeh the assistant professors of Animal Science Department of Islamic Azad University of Khourasgan Branch, for their valuable support and scientific assistance related to presented study and all steps of professional education.

REFERENCES

1. Huber, T.T., 1980. Upgrading residual and by products for animals. Boca Raton, Fla, CRC Press.
2. Dumont, R. and J.L. Tisserand, 1978. Valeur alimentaire dun marc de raisin deshydrate. Annales de Zootechnie, 27: 631-637.
3. Abel, H. and H. Icking, 1984. Zum Futterwert von getrockneten Traubentrestern für Wiederkäuer (Feeding value of dried grape pomace for ruminants). Landw. Forsch, 37: 44-52.

4. Famuyiwa, O.O. and C.S. Ough, 1990. Effect of structural constituents of cell wall on the digestibility of grape pomace. J. Agric. Food Chem., 38: 966-968.
5. Motta Ferreira, W. M.J., Fraga and R. Carabano, 1996. Inclusion of grape pomace, in substitution for alfalfa hay, in diets for growing rabbits. Anim. Sci., 63: 167-174.
6. Jakob, L., J. Hamatschek and G. Scholten, 1997. Der Wein (The wine). Verlag Eugen Ulmer, Stuttgart, Germany.
7. Alipour, D. and Y. Rouzbehan, 2006. Effects of ensiling grape pomace and addition of polyethylene glycol on in vitro gas production and microbial biomass yield. Anim. Feed. Sci. Tech., Doi: 10.1016/I, 137: 138-149.
8. Zalikarenab, L., R. Pirmohammadi and A. Teimuriyansari, 2007. Chemical composition and digestibility of dried white and red grape pomace for ruminants. J. Anim. and Vet. Advances, 6(9): 1107-1111.
9. Baumgärtel, T., H. Kluth, K. Epperlein and M. Rodehutscord, 2007. A note on digestibility and energy value for sheep of different grape pomace. Small Ruminant Res., 67: 302-306.
10. Kayouli, C. and S. Lee, 2007. Silage from by-products for smallholders. Institut National Agromoniquede Tunisie, 43 Ave Charles Nicole 1082 Tunis, Tnisia.
11. Pirmohammadi, R. Golgasem-garebagh, A. and A. Mohsenpur-Azari, 2007. Effects of ensiling and drying of white grape pomace on chemical composition degradability and digestibility for ruminants. J. Anim. and Vet. Advances, 6(9): 1079-1082.
12. Kouhrang Juice Co. Gahro City, Chahar-Mahal Bakhtiari Province, Iran.
13. NRC, 1985. Nutrient Requirements of Sheep. 6th ed. National Academy Press, Washington, D.C.,
14. AOAC, 1997. Methods of Analyses. Association of Official Analytical Chemists. 16 Ed. Publ. AOAC.
15. Van Soest, P.J., 1994. Nutritional ecology of the ruminant. Cornell University Press. Ithaca, NY. USA.
16. Makker, H.P.S., R.K. Dawara and B. Sing, 1988. Determination of both tannin and protein and in a tannin-protein complex. Journal of Agriculture Food Chem., 36: 523-525.
17. Waterman, P.G. and S. Mole, 1994. Analysis of phenolic plant T. Baumgärtel, H. Kluth, K. Epperlein and M. Rodehutscord, 2007. A note on digestibility and energy value for sheep of different grape pomace. Small Ruminant Res., 67: 302-306. metabolites. Blackwell Scientific Publication, Oxford.
18. Kashaani Hospital, Medical Laboratory, ShahreKord city, Chahar-Mahal Bakhtiari Province, Iran.
19. SAS Institute, 1998. SAS/STAT User's Guide: Statistics for windows company. Release 6.12.0.8. SAS Institute Inc. Cary, NC, USA.
20. Liobera, A. and J. Canellas, 2007. Dietary fibre content and antioxidant activity of manto negro red grape (Vitis vinifera): pomace and stem. Food Chem., 101: 659-666.
21. Fontenote, J.P., K.P. Bovard, R. Oltgen, T.S. Ramsey and B.M. Priode, 1977. Supplementation of apple pomace with non-protein nitrogen for gestation beef cow. Feed intake and performance. J. Anim. Sci., 45: 513-522.
22. McNeill, D., M.M. Komolong, N. Gobiun and D. Barber, 2000. Influence of Dietary condensed tannins on microbial crude protein supply in sheep. In: Brooker, J.D. (Ed), Tannins in livestock and human nutrition. ACIAR. Proc., 92: 57-61.
23. Magomedov, M.S. and M.P. Alikhanov, 1996. Silage from grape residues in diets for sheep. Zootekhniya, 3: 12-13.
24. Mole, S. and P.G. Waterman, 1987. Tannins as antifeedents to mammalian herbivores-still an open question? In: Allelochemicals: Role in agriculture and forestry. (Eds). Waller G. R. A. C. S. Symposium Series 330 A. C. S. Washington, D.C., pp: 572-587.
25. Hadjipanagiotou, M. and A. Louca, 1976. A note on the value of dried citrus pulp and grape marc as barley replacements in calf fattening diets. Anim Production, 23: 129-132.
26. Vincelli, P., G. Parker and S. McNeill, 1995. Aflatoxins in Corn. University of Kentucky Cooperative Extension Service, ID-59: 1-10.
27. DeWolf, E., G. Kuldau, P. Lipps, G. Munkvold, P. Vincelli, C. Woloshuk and D. Mills, 2004. Mouldy grains , mycotoxins and feeding problems. In Iowa state University. Ohio-state.
28. CFSAN/FDA, 2001. Guidance for Industry - Fumonisin Levels in Human Foods and Ani FINAL GUIDANCE. Center for Food Safety and Applied Nutrition, Food and Drug Administration,